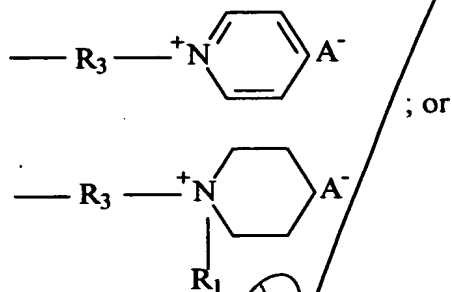
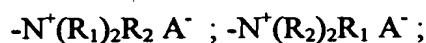


**WE CLAIM:**

1. A polymeric composition, comprising, a polyurethane polymer derived from a polyisocyanate compound and a polyactive hydrogen compound, said polyurethane polymer at least partially endcapped with a group including at least one antimicrobial quaternary ammonium group, said polymeric composition capable of forming a self supporting film.

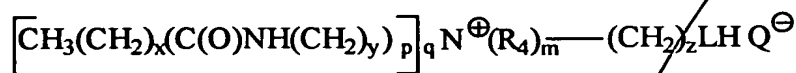
2. The polymeric composition of claim 1, wherein said antimicrobial quaternary ammonium group is selected from:



wherein each  $R_1$  is independently  $C_{1-4}$  alkyl optionally substituted in or on the chain by N, O, and S, benzyl,  $C_{1-4}$  substituted benzyl, and  $\text{Ph-O-CH}_2\text{CH}_2\text{---}$  where  $\text{Ph=}$  phenyl;  $R_2$  is  $C_{8-26}$  straight or branched chain alkyl or  $C_{8-30}$  aralkyl optionally substituted in or on the chain by N, O and S;  $R_3$  is a linkage group which is  $C_{8-26}$ , alkyl optionally substituted in or on the chain by N, O and S; and A is an anionic counter ion and is selected from halogen, alkyl sulfate, carboxylate, sulfonate, sulfate, phosphonate or phosphate.

3. The polymeric composition of claim 1, wherein the antimicrobial quaternary ammonium group is derived from an active hydrogen compound and attached at the terminal position of said polyurethane polymer through a urethane, urea, thiourea, or thiourethane functional group.

4. The polymeric composition of claim 3, wherein said antimicrobial quaternary ammonium group is included in compounds of the formula:



wherein:

m is 1 or 2; p is 0 or 1 and q = 1 or 2 provided that  $m+q = 3$ ; x is 6 to 20; y is 2-8, z is 2-10; L is O, S,  $\text{NR}_5$  or  $\text{NH}$ ; where  $\text{R}_5$  is  $\text{C}_{1-4}$  alkyl or benzyl

5 each  $\text{R}_4$  is independently  $\text{C}_{1-4}$  alkyl, phenyl or  $\text{C}_{6-8}$  aralkyl; and

$\text{Q}^{\ominus}$  is halogen, alkyl sulfate, or carboxylate, sulfonate, sulfate, phosphonate or phosphate.

10 5. The polymeric composition of claim 3, wherein the antimicrobial quaternary ammonium group is an alkylamidopropyldimethylhydroxyalkyl ammonium salt

6. The polymeric composition of claim 1, wherein the polyurethane polymer comprises a cationic stabilizing moiety.

15 7. The polymeric composition of claim 6, wherein the polymeric composition is dispersed in water.

20 8. The polymeric composition of claim 6, wherein the cationic stabilizing moiety is present at a concentration of about 250 to about 5000 g polymer/equivalent.

9. The polymeric composition of claim 7, wherein the dispersion is stable for a period of at least four weeks at 23 °C to 25 °C.

25 10. The polymeric composition of claim 1, wherein said polyurethane polymer is the reaction product of:

- a. an isocyanate terminated prepolymer formed by the reaction of said polyisocyanate with said polyactive hydrogen compound, and
- b. a chain extender having polyactive hydrogen groups.

30

11. The polymeric composition of claim 10, wherein said polyfunctional active hydrogen compound of said isocyanate terminated prepolymer is a polyol compound and wherein the mole ratio of isocyanate groups to active hydrogen groups of the polyol compound is at least 1.6.

12. The polymeric composition of claim 10, wherein the antimicrobial quaternary ammonium group is derived from an active hydrogen compound and attached at the terminal position of the polymer through a urethane, urea, thiourea, or thiourethane functional group.

13. The polymeric composition of claim 10, wherein the chain extender is selected from alkylene polyamines, arylene polyamines, aralkylene polyamines, dicarboxylic acid dihydrazides or mixtures thereof.

14. The polymeric composition of claim 10, where in the ratio of polyactive hydrogen groups on the chain extender and the isocyanate groups on the isocyanate terminated prepolymer is 0.8 to 1.2.

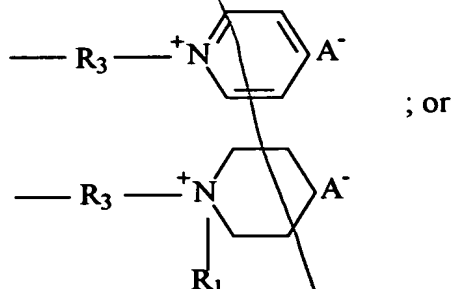
15. The polymeric composition of claim 10, wherein the polyurethane polymer comprises a cationic stabilizing moiety dispersed in water.

16. The polymeric composition of claim 1, wherein the polyisocyanate compound is selected from isophorone diisocyanate, hexamethylene diisocyanate, biuret derivatives of hexamethylene diisocyanate, 4,4'-methylene diphenyl diisocyanate, toluene 2,4-diisocyanate, 4,4'-dicyclohexylmethane diisocyanate, 1,4-cyclohexane diisocyanate, bis(isocyanatomethyl)cyclohexane, 3, 5 - triisocyanatocyclohexane-s-trione or mixtures thereof.

17. The polymeric composition of claim 1, wherein the at least one antimicrobial quaternary ammonium group is located on an addition polymerized group and wherein said polyurethane polymer is derived from a monol vinyl compound and

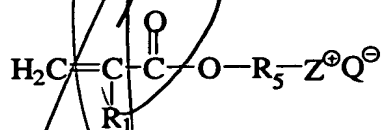
wherein the total equivalents of isocyanate used to form said polyurethane polymer is greater than the equivalents of active hydrogen groups contributed by said polyactive hydrogen compound used to form said polyurethane polymer and said monol or polyol vinylic compound, and the addition polymerization group is formed by reaction of said monol or polyol vinylic compound with a vinylic compound having at least one antimicrobial quaternary ammonium group.

18. The polymeric composition of claim 17, wherein the one antimicrobial quaternary ammonium group of said vinylic compound is selected from



Where each  $R_1$  is independently C1-C4 alkyl optionally substituted in or on the chain by N, O, and S (e.g. hydroxyethyl), benzyl, C1-C4 substituted benzyl, and Ph-O-CH<sub>2</sub>CH<sub>2</sub>- where Ph= phenyl;  $R_2$  is C8-C26 straight or branched chain alkyl or C8-C30 aralkyl optionally substituted in or on the chain by N, O and S;  $R_3$  is a linkage group which is C8-C26 alkyl optionally substituted in or on the chain by N, O and S, and A is an anionic counter ion and is selected from halogen, alkyl sulfate, carboxylate, sulfonate, sulfate, phosphonate or phosphate.

19. The polymeric composition of claim 17, wherein said vinylic compound having an antimicrobial quaternary ammonium group is an alkylaminoacrylate of the formula:



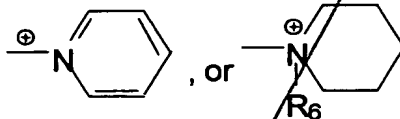
wherein:

$R_1$  is H or  $CH_3$ ;

$R_5$  is a  $C_{2-8}$  alkylene;

$Q^\ominus$  is a halogen, alkyl sulfate, alkylsulfonate or carboxylate;

$Z^\oplus$  is  $-N^\oplus(R_4)_2R_3$ ,  $-N^\oplus R_4(R_3)_2$ ,

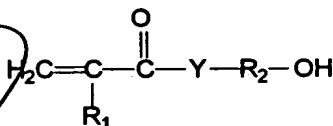


wherein:

$R_3$  is  $C_{8-20}$  alkyl, benzyl, or substituted benzyl;

$R_6$  is H or  $C_{1-4}$  alkyl;

20. The polymeric composition of claim 17, wherein said monol vinylic compound is selected from allyl alcohol, allyl amine, or a hydroxyalkyl acrylic compound of the formula:



wherein:

$Y$  is O or NH;

$R_1$  is H or  $CH_3$ ;

$R_2$  is a  $C_{2-8}$  alkylene;

or mixtures thereof.

21. The polymeric composition of claim 20, wherein the monol vinylic compound is hydroxyethylmethacrylate or hydroxyethylacrylate.

22. The polymeric composition of claim 19, wherein the alkylaminoacrylate is

N, N-dimethyl-N-hexadecyl-N-propylmethacrylate ammonium salt or alkylamidopropyldialkylquaternary ammonium-alkyl-o-carbamato N-ethylmethacrylate.

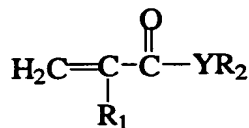
23. The polymeric composition of claim 17, wherein the polyisocyanate compound is selected from isophorone diisocyanate, hexamethylene diisocyanate, biuret derivatives of hexamethylene diisocyanate, 4,4'-methylene diphenyl diisocyanate, toluene 2,4-diisocyanate, 4,4'-dicyclohexylmethane diisocyanate, 1,4-cyclohexane diisocyanate, bis(isocyanatomethyl)cyclohexane, 1,3,5-triisocyanatocyclohexane-s-trione or mixtures thereof.

24. The polymeric composition of claim 17, wherein at least one isocyanate group of the polyisocyanate compound is combined with a monol having a biocidal quaternary ammonium group.

25. The polymeric composition of claim 24, wherein the monol is alkylamidopropyldimethylhydroxyalkyl ammonium salt

26. The polymeric composition of claim 17, wherein the polyfunctional hydrogen compound is at least one polyol vinylic compound.

27. The polymeric composition of claim 26, wherein the polyol vinylic compound is selected from glycerol monoallyl ether, N,N dimethylol -1 butene, 4 (N,N-dihydroxyalkylaminomethyl) styrene, or an acrylic compound of the general formula:



wherein:

Y is O or NH;

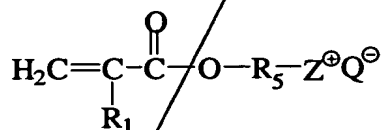
R<sub>1</sub> is H or CH<sub>3</sub>;

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$R_2$  is  $-\text{CH}_2\text{CH}_2\text{N}(\text{CH}_2\text{CH}_2\text{X})_2$ ,  $-(\text{CH}_2\text{CH}(\text{OR}_3)\text{CH}_2\text{O})_n-$   
 $\text{CH}_2\text{CH}(\text{OR}_3)\text{CH}_2\text{OR}_3$ ;

in which X is OH,  $\text{NH}_2$  or alkoxyated derivatives of OH or  $\text{NH}_2$ , each  $R_3$  is independently  $-(\text{C}(\text{O}))_l\text{R}_4$  or H where  $R_4$  is  $\text{C}_{1-18}$  alkyl and wherein at least two  $R_3$  groups are H and n is 0-10;  
or mixtures thereof.

28. The polymeric composition of claim 27, wherein the vinylic compound having an antimicrobial quaternary ammonium group is an alkylaminoalkyl acrylate of the formula:



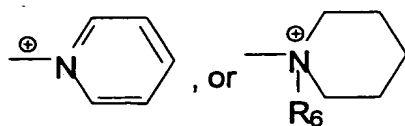
wherein:

$\text{R}_1$  is H or  $\text{CH}_3$ ;

$\text{R}_5$  is a  $\text{C}_{2-18}$  alkylene;

$\text{Q}^{\ominus}$  is a halogen, alkyl sulfate, alkylulfonate or carboxylate;

$\text{Z}^{\oplus}$  is  $-\text{N}^{\oplus}(\text{R}_4)_2\text{R}_3$ ,  $-\text{N}^{\oplus}\text{R}_4(\text{R}_3)_2$ ,



wherein:

$\text{R}_3$  is  $\text{C}_{8-20}$  alkyl, benzyl, or substituted benzyl;

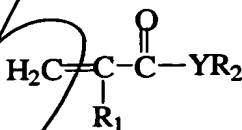
$\text{R}_6$  is H or  $\text{C}_{1-4}$  alkyl;

29. The polymeric composition of claim 1, wherein said polymeric composition is water soluble.

30. The polymeric composition of claim 1, wherein the polymeric composition is water insoluble.

31. A polymeric composition comprising, a polyurethane polymer derived from a polyisocyanate compound a polyactive hydrogen compound having a pendant addition polymer chain wherein the polyurethane polymer is derived from polyisocyanate and a polyactive hydrogen compound, the polyactive hydrogen compound comprises a polyol vinylic compound, and the pendant addition polymer chain derived from a reaction of the polyol vinylic compound with a vinylic compound having at least one antimicrobial quaternary ammonium group.

32. The polymeric composition of claim 31, wherein the polyol vinylic compound is selected from glycerol monoallyl ether, N,N dimethylol -1 butene, 4 (N,N-dihydroxyalkylaminomethyl) styrene, or an acrylic compound of the general formula:



wherein:

Y is O or NH;

R<sub>1</sub> is H or CH<sub>3</sub>;

R<sub>2</sub> is -CH<sub>2</sub>CH<sub>2</sub>N (CH<sub>2</sub>CH<sub>2</sub>X)<sub>2</sub>, -(CH<sub>2</sub>CH(OR<sub>3</sub>)CH<sub>2</sub>O)<sub>n</sub>-CH<sub>2</sub>CH(OR<sub>3</sub>)CH<sub>2</sub>OR<sub>3</sub>;

in which X is OH, NH<sub>2</sub> or alkoxylated derivatives of OH or NH<sub>2</sub> each R<sub>3</sub> is independently -(C(O))<sub>L</sub>R<sub>4</sub> or H where R<sub>4</sub> is C<sub>1-18</sub> alkyl and wherein at least two R<sub>3</sub> groups are H and L = 0 or 1, and n is 0-10;

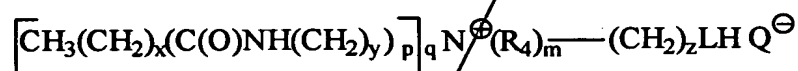
33. The polymeric composition of claim 31, wherein the antimicrobial quaternary ammonium group is present in the composition at a concentration of about 1000 to 20,000 g polymer/equivalent antimicrobial quaternary ammonium



group.

34. The polymeric composition of claim 31, having a biocidal quaternary ammonium group covalently attached to the polyurethane polymer derived from a mono-active hydrogen compound.

35. The polymeric composition of claim 34, wherein the mono-active hydrogen compound includes compounds of the formula:



m is 1 or 2; p is 0 or 1 and q = 1 or 2 provided that m+q = 3 ; x is 6 to 20; y is 2-8 , z is 2-10; L is O, S, NR<sub>5</sub> or NH; where R<sub>5</sub> is C<sub>1-4</sub> alkyl or benzyl

each R<sub>4</sub> is independently C<sub>1-4</sub> alkyl, phenyl or C<sub>6-18</sub> aralkyl; and

Q<sup>⊖</sup> is halogen, alkyl sulfate, or carboxylate, sulfonate, sulfate, phosphonate or phosphate.

36. The polymeric composition of claim 34, wherein the mono-active hydrogen compound is alkylamidopropyl dimethylhydroxyalkyl ammonium salt.

37. The polymeric composition of claim 31, wherein the polyurethane polymer comprises a cationic stabilizing moiety dispersed in water.

38. The polymeric composition of claim 37, wherein the cationic stabilizing moiety is present at a concentration of about 250 to about 5000 g polymer/equivalent cationic stabilizing moiety.

39. The polymeric composition of claims 31, wherein the polyfunctional active hydrogen compound is selected from the group consisting of polyolefin polyols, polycaprolactone polyols, polyester polyols based on isophthalic acid and/or terephthalic acid, polyols based on polydimethylsiloxanes, polyether polyols and combinations thereof.

40. The polymeric composition of claim 31, wherein the antimicrobial activity is not leachable and therefore durable.

5 41. A method of preventing the growth of microorganisms on an substrate comprising coating the substrate with an aqueous dispersion of a biocidal polyurethane polymer comprising a polyurethane composition according to claim 1.

10 42. An article comprising a substrate coated with the polymeric composition of claim 1.

15 43. An article according to claim 42, wherein the substrate is roofing felt, roofing shingle, roofing granules, tile, concrete, metal, polymeric, cloth, fibers or wood.

20 44. An article according to claim 42, wherein the substrate is a medical article.

25 45. A polymeric composition, comprising, a polyurethane polymer derived from a polyisocyanate compound and a polyactive hydrogen compound, said polyurethane polymer at least partially endcapped with a group including at least one antimicrobial quaternary ammonium group, wherein said polymeric composition is soluble in water.

30 add A2 > add B7